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AMERICAN DYESTUFF REPORTER

Vol. III, No. 8

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IN THIS ISSUE

Mars and the Golden Rule

Dyestuffs: Part I

By Dr. Lewis J. Matos

The Fastness of Dyestuffs to Light and Ultra Violet Ray Exposure

By Dr. E. Wallace Pierce

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AMERICAN DYESTUFF REPORTER

A Weekly Publication devoted to

DYESTUFFS, COLORS and ALLIED CHEMICALS

"Circulated Everywhere Dyestuffs are Used"

Vol. 3 New York, August 19, 1918 No. 8

MARS AND THE GOLDEN RULE

After the War the Dye Industry Will Need the Government's Help—The Government Needs YOUR Help NOW!

SOME will have it that rules are made to be broken, but it will be found that in all instances these self-appointed arbiters are referring to man-made rules. Man, as he journeys through life, encounters more rules than one could menace with the proverbial stick. He finds them in all shapes and in assorted sizes—children's, ladies', misses' and gents'—and all are intended for his guidance. He heeds or ignores them in varying degrees, according to what manner of individual he happens to be.

Those made by man he often flouts—and gets away with it, too, as likely as not. But those set down by nature he side-steps at his own peril, for nature, as the reader may possibly have heard somewhere, is inexorable when it comes to the eye-for-eye and tooth-for-tooth idea. However, this is somewhat beside the main theme, which was intended to lead playfully up to a consideration of the alpha and omega of nature's rules—the justly celebrated Golden Rule.

Let the reader be not alarmed. If the opening bars of this homily smack too strongly of a theological discussion to suit his tastes, he will soon find it coming back to more material things. We will merely pause to point out that although this paragon of rules was supposed to have originated with the advent of the Christian era, it is a safe surmise that it was and still is unconsciously obeyed and practiced by more races that never heard of it in their lives than any other.

The dyestuff industry is shortly to have an opportunity of practicing it. The United States will next month call upon the men and women of this country to support a great Government loan to aid in winning the war. The issue of bonds for the Fourth Liberty Loan will equal or exceed $6,000,000,000. The tentative date for opening the sale of the new certificates is September 28. It will continue about three weeks.

It has been stated that the nation's war program will necessitate the expenditure of $24,000,000,000 during the fiscal year ending June 30, 1919. This money will be raised in two ways: by taxation and by the issue of bonds.

Taxes of all kinds added $4,000,000,000 to the nation's treasury during the past fiscal year, when total expenses were between twelve and thirteen billion dollars. We cannot contemplate doubling the national budget without increasing the tax income in the same ra-

tio. Plans are now under way to make substantial additions to the amounts derived from war profits and personal incomes. Should these additions swell the tax returns to $8,000,000,000, there would still be left twice this amount to be raised by the sale of bonds.

Enormous as this sum appears on paper, it still barely scratches the surface of our national resources, which, as Thomas W. Lamont recently pointed out, were estimated at the beginning of the war at $250,000,000,000. The total amount derived from the sale of Government securities to date is $9,978,785,800.

Without making any rash promises for the future or attempting to paint the chances of the Allies in too rosy colors, there is a possibility that this may be a "Victory Loan." Nearly 1,500,000 United States soldiers are now in France. More are landing every day. The way the "Yanks" beat back the Germans during the July drive and their earlier victories at Cantigny and Belleau Woods, together with the successes of the French and British, are sure signs, military experts say, that the fortunes of war have probably swung our way.

The industrial workers of the country will play a more important part than ever before in raising the new loan. They have profited largely through the war. In many cases, increased wages have far outstripped the advanced cost of living so that the so-called "working man" is actually in better circumstances now than he was before the world conflict. He will be called upon to meet his obligation to the Government in full.

Concerted efforts will be made all over the nation to canvass every industry. This is specially true in the Second Federal Reserve District, where a remarkable organization has been built up to secure subscriptions in New York City. This organization is known as the "Rainbow Division." It is composed of trade committees representing every industry in the metropolis. The division accounted for $409,367,150—more than one-third of the city's quota—in the Second Loan. In the Third Loan, this sum was bettered by $155,399,950. Still further progress is expected during the coming campaign, because of the finely perfected organization of the Advisory Trades Committee—the executive or directing committee of the Rainbow Division.

The Advisory Trades Committee is headed by G. deB. Greene, of the firm of E. H. Rollins & Sons, of 42 Exchange Place. Mr. Greene, chairman, and Craig Colgate, vice-chairman, have obtained a record and rating of every business house in the city. There will be in the neighborhood of 100 subcommittees, each representing a trade, canvassing for subscriptions. When these committees begin work late in September, each will be supplied with a list of names of every firm to be visited. One advantage of this listing is that it will prevent the work of committees from overlapping. Another is that it will make easier their work and insure that the full period of the campaign is devoted to actual canvassing rather than organizing. This trade list will give the number of employees in every industrial house in New York City.

The personnel of all the committees is not yet complete. Each will have a chairman, appointed by Governor Benjamin Strong, of the Federal Reserve Bank of New York. The chairman will meet, then select his own co-workers.

Should the Government call for $6,000,000,000, every committee will have to double its quota allotment of the Third Loan. At the beginning of the Third Loan, all the committees were divided into three groups or classes: those expected to raise $10,000,000 or over, those expected to raise from $2,000,000 to $10,000,000 and those expected to raise under $2,000,000. This plan was a great success, and caused

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considerable friendly rivalry among the various committee teams.

Rivalry was further stimulated by the awarding of Honor Flags to firms, 60 per cent of whose members and employees had bought bonds. Five thousand of these flags were awarded. More than 1,500 of the firms earned 100 per cent Honor Flag—that is, every worker in the concern subscribed to the loan. The Honor Flag system will undoubtedly be a part of the coming drive.

Seventy committees reached and passed their total for the Second Loan during the last drive. Of these, the one that made the greatest increase was the electrical committee, headed by Theodore Beran. This committee was awarded an industrial Bull's-eye Honor Flag containing twenty-one stars—each star indicating an increase of 50 per cent over the total of the preceding loan.

Ever since the war started, great emphasis has been laid upon the efficiency of Mars as an educator. The gap between the war god and the Golden Rule would seem to be a wide one, but it is not. Since Mars has been in the ascendancy from the year of Dis-Grace 1914, he has taught us many things, and the application of the Golden Rule has been one of them.

After the war the dye industry of this country expects help from the Government—and this it is certain to get. Just now the Government itself is in need of help. Begin NOW to work for the oversubscription of the Fourth Liberty Loan in your industry.

ANILINE DYES & CHEMICALS, INC., TAKES OVER FORMER GEISENHEIMER INTERESTS

Announcement has been made of the dissolution of the firm of Geisenheimer & Co., owing to the retirement of Mr. Theodore Geisenheimer from business. The property and assets formerly belonging to the firm have been acquired by Aniline Dyes & Chemicals, Inc., of which Alfred F. Lichenstein is president and treasurer. The first vice-president of the concern is W. H. Van Winckel, formerly sales manager for the Dow Chemical Co., and the second vice-president is Robert Hilton, vice-president of the Ault & Wiborg Co., Cincinnati, Ohio. Henry A. Datter has been chosen secretary.

The new concern will continue the business of the old firm and will enlarge its selling staff for the continuation of the sole selling agency for the dyestuffs, intermediates and chemicals manufactured by the Ault & Wiborg Co. The principal offices of the new corporation will be at Cedar and Washington Streets, New York City, with branch offices at Boston, Philadelphia and Columbus, Ga.

According to a report from the "Agencia Americana," American makers of vegetable colors have succeeded in producing 500 out of the 700 shades produced by the German industry, and in order to develop the importation of natural tinctorial materials to the utmost, have ordered heavily from Brazilian producers, and have also asked the cooperation of the government in securing transport facilities.

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DYESTUFFS

By Dr. Louis J. Matos

PROBABLY one of the most comprehensive and authoritative expositions of the dyestuff industry and its progress in this country was vouchsafed members and guests of the Franklin Institute at one of the stated meetings of that organization by Dr. Louis Joseph Matos, whose paper, delivered on that occasion, has just made its appearance in the *Journal* of the Institute dated for August.

There are few men better fitted to discuss this subject than Dr. Matos. Probably the dean of chemical engineers in this country in point of years of actual service in that capacity, his achievements in connection with the dyestuff industry are too well known to need citation here. Realizing the value of this article to readers of this publication, both for general interest and for future reference, we herewith reproduce it, as it appeared in the pages of the *Journal of the Franklin Institute*, in four installments, of which the following is the first:

Part I.

Mr. Chairman, Ladies and Gentlemen: In addressing you this evening upon the subject of dyestuffs, I am not unmindful of the wide extent of the subject and also of the very great amount of information and data, both general and technically special, that has been given to the public from various sources since August, 1914.

During this intervening period, and particularly during its first twelve months, when there was manifested so much concern regarding the probable supplies of coal-tar colors for our several dye-consuming industries, the wildest rumors regarding the possibility of dye production in this country were current, and there was hardly a day but some new and far-reaching discovery was announced in the columns of the daily papers that would unlock the tightly-closed secrets of the German dye makers, and unlimited quantities of much-desired anilines would flow forth.

We know now that much of this publicity was the result of a total misconception of what dye production is, and the very great majority of those who were to relieve the serious dye situation are now at labor in other fields.

The dye industry, like many other fields of activity, has been developed by gradual stages through the years, and from the most modest beginnings. It has grown and increased in importance from the time when the artistic ideas of people were in a very crude state.

From the very earliest times of which we have record there is evidence that certain coloring matters of organic origin were in use, the two most important being indigo and madder, and it is interesting to note that these two items have come down to us continuously to the present.

It is not necessary to burden you with a list of those coloring matters quoted in the Scriptures, but it may be interesting to record the fact that in Europe, prior to 1,600, the art of dyeing, even at that time, had attained considerable importance on account of the skill of the dyers. There were currently employed at that period:

Indigo, madder, litmus, Brazil wood, lac dyes, kermes, buckthorn berries.

These several dyewares, or the coloring matter extracted from them, were mostly used for dyeing woolen fabrics and linen.

During the long years between 1600 and 1860, there were gradual additions to this old list of natural colors, which then included besides indigo, madder, and the astringents—sumac and gallnuts—peachwood, camwood, barwood, sanders wood (tropical woods); cochineal (Guatemala), fustic (Cuba), weld quercitron bark (Pennsylvania), cutch and turmeric (Burma and Mexico). With this line of dyewares, the dyer

was in a position to meet most of the demands made upon him for dyeing not only wool, but cotton and silk as well.

In certain localities, notably in parts of France, some coloring matters obtained from plants indigenous to the region in which the dyer worked, were used. Among these dyewares may be included safflowers and saffron, the former much employed for a most beautiful shade of pink, and the latter for a shade of yellow.

As the fame of the dyer's products and skill spread, the interest of dyers in other localities became excited, and the desire to produce similar results was aroused. In consequence, the secrets of the dyer, handed down from father to son, were jealously guarded, so that competition might not be able to duplicate their work. We have evidence of this condition when we examine the recipes extant in old formula books of dyers of past generations, notably in the production of the so-called "spirits," those mysterious compositions of tin and certain acids, which were designated largely by misleading names.

The dyer of the period prior to the introduction of the coal-tar dyes was indeed a real master craftsman. While he may not have had the refined surroundings of the dyer of the present, nor the highly developed scientific aids that are now so common, he produced results that are to be regarded as marvelous. When we read old notes and recipes, and bring to our mind the uncertain composition of the various "infusions" that the dyer employed, we are compelled to acknowledge that the workman of the period was one who really knew his trade.

The "infusions" or "liquors" made use of at that time were largely weak liquid extracts made by boiling the crude natural dyewares with water, then straining and using the stock solution as the dyer's demands required. At other times, such as for logwood, a given amount of the ground wood was simply boiled out, and the total amount of infusion so obtained was employed for one batch of material to be dyed. This crude method of operating was the origin of the now highly-developed logwood industry which flourishes both in this country and in Europe, especially in France, from which country the very finest logwood extracts have come.

There were other natural dyewares analogous to logwood, which occupied a prominent position in the catalogue of active coloring matters, and which include peachwood, barwood, sanders wood, and other similar woods, the majority of which are natives of the tropics. They were chiefly used for producing red, brown and many compound shades upon wood in combination with logwood. These woods were imported and ground, and the ground or rasped wood was sold to the dyer, who made the infusions as his requirements called for. Some of these now scarce and curious dyewares were used in Philadelphia even as late as 1895, where they were employed for producing shades upon heavy carriage robes and in dyeing seal plushes. From that

(*Continued on page* 12)

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Published weekly by
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Pointed solely toward the welfare and growth of the American Dyestuff Industry. Unbiased contributions appreciated

A. P. HOWES, Editor and Publisher

Domestic Subscription, $3 per year. Foreign, $4. Advertising rates on request.

We have repeatedly expressed the opinion in these columns that American dyestuff manufacturers ought to take active measures to insure a more intelligent attitude on the part of consumers of American-made colors.

This is a tremendously large subject, and one in which everybody in the trade is, at least theoretically, vitally concerned. Every dyestuff manufacturer with whom we have talked agrees at once that a great amount of educational work is necessary, but when it comes to a question of ways and means or of his individual participation in such work, we note a disposition on the manufacturer's part to "let George do it."

As a matter of fact the manufacturers are so vitally concerned with their technical manufacturing problems which have to do with the actual production of colors that they have very little surplus time or energy to give to such general subjects as educational publicity.

An effort to educate all the women of the country as to the relative merits of American-made dyestuffs—what colors are really reliable, what are unsafe and what progress is being made toward the solution of remaining difficulties—would be a task so large as to seem almost impossible of successful accomplishment at the moment. There is, however, one class of people whose intelligent interest concerns the welfare of the dyestuff industry more than that of any other, and which in itself is not so extremely large. This class comprises the executives and salespeople in retail establishments who sell dyed fabrics and garments to the consumer. These people, as a whole, are reasonably intelligent, and would prefer to give satisfactory answers to customers inquiring about colors than to be compelled to take refuge behind the oft-repeated assertion that "we cannot guarantee American colors." We believe that the stores would lend the heartiest sort of co-operation to any movement designed to increase the intelligence of their employees in this direction, but it remains for the dyestuff manufacturers to institute some such campaign.

The National Aniline & Chemical Co., Inc., has been doing very excellent work in this direction through the showing of its exhibit at various department stores, but this, of course, is only a start in the right direction. The REPORTER does not profess to know of any royal road which will lead in a brief space of time to a complete enlightenment of all retail salespeople, but it does believe that consistent work in this direction would accomplish very satisfactory results. Just what lines efforts of this sort should follow would have to be worked out carefully by a committee of dyestuff manufacturers. But that something could be accomplished if the matter were taken up seriously, we believe to be certain.

It would seem to us that the intelligent use of certain of our reputable dry goods trade papers, not alone by using their advertising pages but by enlisting their co-operation in the form of some sort of active campaign among the salespeople, might produce very desirable results

Some may think it a foolish policy for a dyestuff trade paper to recommend the expenditure of money in channels other than dyestuff trade papers, but we are sufficiently broad-minded to believe that our own success is bound up with the success of the industry, and that we cannot expect to receive any considerable percentage of the dyestuff manufacturers' advertising appropriations unless the condition of the industry as a whole justifies this expenditure.

The REPORTER would be glad to co-operate to the extent of its ability in any movement looking to the accomplishment of the purpose outlined above.

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The evolution from explosives to dyes is the logical development of the dyestuff industry from both a chemical and engineering standpoint. The manufacturer of explosives enters upon the production of coal tar dyestuffs with these important advantages.

First, the explosives manufacturer starts with the necessary raw materials. In his munition plants he produces the bases which are required. The immense output of his acid plants is at his disposal. In his chemical factories he manufactures many of his principal intermediates. He is therefore assured of sufficient quantities of the required ingredients—all products of this country—to meet his various needs.

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His chemical and engineering organization has had long training in the closely related explosives industry and is able through the experience gained to overcome difficulties which would be insuperable to others less fortunately situated.

The high quality of his raw materials is guaranteed because they are made under his constant supervision and control and under the very exacting requirements of the explosive industry. He is consequently able to maintain, as no other manufacturer, the high standard of his finished product.

As the world's largest manufacturer of explosives the Du Pont Company enjoys these advantages to an unusual degree. It has already made possible the laying of a broad and secure foundation and the development of dyestuffs of the greatest commercial and industrial importance. It is the strongest guarantee of the permanency of our undertaking and of the final emancipation of the dyestuff industry from foreign domination.

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The Arlington Works, 725 Broadway, New York, N. Y., Ivory Py-ra-lin and Cleanable Collars
Harrison Works, Philadelphia, Pa., Paints, Pigments, Acids and Chemicals.
Du Pont Dye Works, Wilmington, Delaware, Coal Tar Dyestuffs.

DU PONT

DYESTUFFS

(*Continued from page 9*)

time until the outbreak of the war, the decline in the use of those products was rapid and complete. When the war curtailed many of the artificial colors, the dyers had to fall back upon these antiquated coloring matters, and after a time some were imported and sold at unheard-of prices on account of the great demand and scarcity of stock. Afterwards, when domestic producers of artificial colors began to make deliveries, the market for the older dyewares fell off again. It is curious to note, however, that during the "dyestuff famine," when these antiquated coloring matters were brought to light, very few dyers knew anything about their application, and, as a consequence, the dyed material that was delivered from mills did not measure up to the usual current standards for fastness, and therefore dyes were condemned off-hand, when, as a matter of fact, the fault was not with the dyestuff, but with the inexperience of the dyer, due to his unfamiliarity with the dyestuff he was using.

There are to-day many experienced cloth dyers who are expert in the application of logwood—for be it remembered that logwood has always been a standard dyeware for black on wool, and against which artificial blacks for the same purpose are judged—and these same dyers are absolute failure when it comes to using other colors. The same remark applies with greater force to the dyeing of silk. There are no dyestuffs of coal-tar origin that can duplicate the well made logwood blacks on this fiber. Black dyeing in the silk industry is a trade by itself, and deservedly so.

Indigo has been handed down to us from the earliest times as the one blue color that has been regarded as having a degree of fastness far in excess of any product yielding the same shade. It is a native of certain portions of the tropics of both hemispheres, but the greatest amount of natural indigo has by far been produced in British India.

Indigo, as it appears in commerce, is the blue coloring matter obtained by oxidizing the juices of the indigo plant. The plant at maturity is cut and carted to the indigo factory, where it is placed in huge vats, water run on, and the whole allowed to ferment. At the proper stage of fermentation, the liquors containing the indigo in a chemically reduced state (indigo white) are run off and agitated, either by being whipped by hand or by revolving light paddle wheels. This agitation causes atmospheric oxidation of the indigo white, which is soluble, to indigo blue, which is insoluble and precipitates. This precipitation is then filtered and the cake pressed, then cut to proper size and branded while still moist, and finally dried. It is then ready for the market.

Indigo as a source of blue color for textiles has had an unbroken period of use for centuries. It is employed in dyeing both wool and cotton; the former by means of both so-called "vats" and as "extract," the latter always in the vat. Vat dyeing means that the indigo is reduced to the state of indigo white and then subsequently oxidized to indigo blue on the fiber. "Extract blue" is dyed by means of a solution of indigo in sulphuric acid, formerly called "chemic," and in later years more carefully prepared by purifying the sulphuric acid solution of the indigo. A highly refined dry indigo extract is sold as indigotine, but it is in reality only a disulphonic acid of indigotine—the real blue color of indigo in soluble form.

Madder is another of the natural dyewares that has been in use for centuries, being employed most commonly for the production of reds—the red which we are most familiar with being termed turkey red. Formerly, and up to the recovery in 1868 of artificial alizarine by Graebe & Lieberman, its cultivation and preparation for market was a most important and flourishing industry. When artificial alizarine became a commercial reality, the madder industry rapidly declined to very small proportions, and as a dyeware it is no longer to be considered.

The several coloring matters to which I have directed your attention, occupying positions of first importance in the

dyer's art, are mentioned for the purpose of preparing the way to the serious consideration of the dyes of artificial origin, and by which the great majority of the older dyes were completely displaced.

The first dyestuff of artificial origin is the well-known Perkins' violet, and its discovery in 1856 paved the way for rapid strides in organic chemical research that has continued from that date to the present time, and the number of patents granted by various industrial countries attest the activity of chemists in the direction of dye production, although not every patent granted represents a dye that has attained commercial interest.

The more important artificial discoveries may be briefly summarized as follows:

Perkins' violet or mauvein (epoch)	1856
Fuchsine or magenta (Hofmann)	1858
Aniline black (Lightfoot) epoch)	1862
Nicholson's blue	1862
Methyl violets (Poirrier)	1866
Safranine	1868
Artificial alizarine (Graebe and Lieberman)	1868
and its manufacture in	1869
Indigo blue from isatin	1870
Eosine	1874
Cachou de laval (first sulphur color)	1873
Triphenylmethane dyes	1876
Methylene blue	1877
Fast red	1877
Azo scarlets	1878
Propiolic acid for indigo	1880
Congo red (first direct or substantive color)	1884
Tartrazine (first fast acid yellow for wool)	1885
Primuline and the "ingrain" colors	1887
Carbazol yellow	1888
Diamine fast red F	1889
The thioflavines	1889
Indigo from phenylglycocol (Herman)	1890
Cyanine	1891
The rhodamines	1893
Vidal black (first sulphur black)	1895

Synthetic indigo, vat colors, etc.

This list could be greatly augmented, but it is sufficient to indicate the gradual extent of industrial and chemical research that has developed the great number of dyes that find use in some or all of the industries employing coloring matters.

The particular branch of dye research that includes the so-called azo colors, deriving its impetus by the discovery of Peter Greiss in 1862, has been most productive of results, and for the time engrossed the attention of the great majority of dye chemists, with the result that there were innumerable products given to dyers that traced their origin to the Greiss reactions. This particular group of dyes—azo dyes—is chemically subdivided into thirteen divisions, and there has been made necessary a vast

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amount of chemical research covering in their extension and development the production of those raw materials that are necessary for each particular dye. This phase of dye chemistry has been to a very great extent neglected in this country, but during the past three years it has been receiving a degree of attention never before attempted in private laboratories, works' laboratories and in colleges.

In the operation of dye making, certain raw materials are necessary. These raw materials are obtained in the first instance from certain distillation products obtained from coal tar; the most important for the purpose of illustration are benzol and naphthalene.

From benzol there are obtained a succession of secondary products, each the result of a definite reaction and each possessing certain properties.

From naphthalene there are also obtained by various reactions a number of products aggregating at least one hundred and seventy-five, and each of which possesses properties that make it useful for certain further reactions. If we study the chemistry of several of these benzol or naphthalene derivatives, we will at once be impressed with the immense amount of painstaking research work that must have been done in order to ascertain the properties of each product, and the possibility of combining each of them with other dissimilar bodies, for the purpose of obtaining a dye or coloring matter different from any other before produced. It is this constant investigation that has been at the bottom of the seemingly endless array of known dyes.

If the dye chemist has only to give his attention to combining various raw materials, his work is extremely simple, but where he has to work out the production of new raw materials, then his work becomes extremely complicated.

In studying the chemistry of the commercially useful derivatives of naphthalene, mostly sulphonic acids, we are at once impressed with the limited sphere of labor undertaken by the investigators, and a digest of the patents will show that the labors of these investigators have been quite active within these limits. Each investigator has concentrated upon some one, or possibly two, groups of colors, and their necessary raw materials, leaving to others similar work along diverging lines.

The group of azo dyes includes the greater number of dyestuffs that are available for cotton and wool, and for a long time after the classic discovery of Peter Greiss occupied the attention of many chemists, with the result that a very extensive range of colors was produced with which the dyer was enabled to obtain shades of almost every conceivable hue.

One of the most important discoveries was the production of the so-called azo scarlets, which, in a short time, entirely displaced cochineal. These original scarlets were later considerably improved upon, and brilliant shades were made possible possessing extreme fastness to light. Several of these scarlets are much employed in other industries, notably for the staining of paper.

The ultimate production of wool blacks marked the beginning of a revolution in dyeing certain textiles, which were formerly dependent upon logwood, and in time the gradual decline of this dyeware became quite noticeable.

It is unnecessary for me to dwell upon the technical details for the production of these various products, since the outlines of the most important may be found in many treatises and in the patent literature.

(*To be continued*)

Dealers and manufacturers handling direct black continue to experience difficulty in meeting local and foreign inquiries for this coal-tar dye, owing to the steady demand. Practically the entire present output is booked ahead.

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THE FASTNESS OF DYESTUFFS TO LIGHT AND ULTRA-VIOLET EXPOSURE

By Edw. W. Pierce, Chief Chemist U. S. Cond. & Test. Co.

The following article, which appeared recently in the *Color Trade Journal*, should be of great interest to readers of the REPORTER:

Of all the tests applied to dyed fabrics, the most empiric and inaccurate is the exposure to light. There are several elements which enter into the gradual destruction of the coloring matter without our being able to either control or measure any one of them. The original method, still extensively practiced, is to nail a sample to a board, covering a portion, and allow sun and weather to exert their influences during a stated period. At the end of the period the dust is beaten out and a decision reached as to whether the resistance has been good, fair or bad. Some observers take the precaution to expose at the same time a well-known standard, but the majority usually make a single exposure of the sample in question. Where it is too troublesome to go on the roof, we often find samples exposed behind the glass of a window with a southern exposure. The various departments of the United States Government not only sanction but require such tests for a period of thirty days, and are likely to reject any goods that do not resist as well as the standard sample.

The criticism of the exposure test is based on the following facts: The period of time has no constant relation to the actual amount of solar radiation received by the sample. This is on account of the variations in the weather and the variation in the intensity and duration of sunlight from month to month. The sample is also subjected to varying amounts of moisture, which in conjunction with the sunlight produce a bleaching rather than a fading effect. Lastly, the apparent fading is measured mostly by personal opinion. A change of color being counted more than a real loss of color.

Samples composed of heavily dyed fibers mixed with white fibers show less change of color than lighter, evener tones which match the same general effect. Further, there is no point where we may decide that fading has begun. Fading is so gradual that the determination of it depends on individual ability to recognize it.

It is hardly fair to any dye to make tests of its fastness to light on an arbitrary percentage of dye on a sample. It is self-evident that pale shades will resist less than full shades, but it becomes difficult indeed to decide how heavy a dyeing of one color should be compared with another in order to have a fair comparison. As an illustration, we may compare dyeings of 1 per cent cach of naphthol yellow S with tartrazine and decide that the latter is the much faster dyestuff. If we dye 1 per cent tartrazine and match it with 4 per cent of naphthol yellow S, which being overdyed seems redder and flatter, then the naphthol yellow will resist light longer than the tartrazine. This particular feature can be overcome in the comparison of two dyes of different shades and

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strengths by using both in separate combinations for matching the same shade. We may make a brown or a neutral tone from three colors, using in each case the one to be tested and having the two other colors the same in both cases. Then an exposure of both under the same conditions will give a better idea of their relative fastness.

On account of the uncertainties cited above it has been found necessary to make the test more accurate by the use of a more uniform source of light. Mills bidding on army contracts could not always wait thirty days for the result of an exposure test, and if the time was during the winter, or the weather had been bad, were not sure of later developments.

In finding a substitute for sunlight we are at once confronted with the fact that the exposure test is not only a molecular disruption, due to the ultra-violet rays in the sunlight, but is in part due to some of the short visible rays that pass through glass, and is combined with a bleaching or oxidation due to the action of the rays on the fibers in the presence of moisture. All are familiar with the bleaching of linen spread in a damp condition on the grass in the sun, and it is also a fact that dry linen in the sun will not bleach, but turns yellow.

It is quite possible for a dye to be resistant to ultra-violet rays and yet be easily bleached, and the reverse is also true.

The first step was to obtain a source of rays which would be fairly constant and yet be powerful. In due time a type of lamp was found which was being used for water sterilization.

The makers adapted a stand and hood to protect the eyes, and a number of dyed samples were tested to ascertain the value of the method.

Early in the experiments it was believed that some simple system of measurement could be devised, such as the decomposition of a liquid in a quartz tube and the measurement of a liberated gas, but no method of this kind has so far proven a success. Photographic methods were also discarded because practically all photo-chemical reactions are produced as well by the short visible rays that pass through glass. The Bureau of Standards recommends the photo-electric cell, but we have no information as to how the visible rays are separated.

Practical trials in comparison with dry exposures to strong sunlight gave an approximate value of 1 to 8. This is, one hour under the quartz mercury vapor tube at a distance of 18 inches equaled eight hours in the strong sun, or an average day. This is as close to a comparison as may be hoped for, because the quality and power of sunlight is so uncertain in character. It is realized that sunlight in passing through the atmosphere has lost many of its shorter rays and that the radiation from the quartz tube differs from it in many respects, yet, in the main, the results are similar if we exclude the action of moisture.

When the mercury vapor quartz lamp is started and the resistance is still high and the voltage low, particularly when

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the air is humid, there is an abundant production of ozone. No ozone is perceptible, however, when the resistance had dropped to 3.5 and the voltage risen to 170. We may safely disregard the formation of ozone as a factor in the fading, although it has been demonstrated that it dissolves in water with the formation of peroxides.

The reactions on the fiber are varied and complicated. Yellows on wool, containing nitro groups, first turn dark and show evidence of reduction. As wool contains sulphur, and as the exposure of undyed wool causes a yellowing and a development of a basic substance, this can be explained. A true fading follows the darkening of such dyes. Other dyes not containing nitro groups fade regularly. Certain of the vat colors, notable for their resistance to weather and oxidation, fade readily. These facts seem to indicate that the general effect is that of an alkaline reduction, especially since acid oxidizing agents often restore the color.

Exposures were made in the wet condition and the results differed greatly from the dry tests. It has been shown that water yields peroxide, and also that peroxide is decomposed by ultra-violet radiation, but we can draw no conclusions from mass reactions when we are dealing with such subtleties as colloid dyes adsorbed by colloid fibers. It is probable, however, that an ultra-violet exposure of a damp sample would be a closer approximation of actual weather exposure, but in this case we would exaggerate the bleaching action.

At present the test simply consists in exposing part of the sample, at a distance of 18 inches in comparison with a standard sample, and disregarding the absence of moisture. The results are obtained quickly and, although there are a few dyes that seem irregular, the results are in general quite dependable. The irregularities may generally be corrected by acids or oxidizing agents. This is a safe test in every case before making a final comparison.

Mixed fabrics, like the army olive drab, show a yellowing of the white wool in the mixture, but a little weak acetic acid restores its whiteness and leaves only the faded effect. There is plenty of opportunity for further technical investigation along these lines, and the specification of standard conditions by some authoritative body is much needed.

That the interest of the English lay public in dyestuffs is becoming keener than ever is shown by the fact that for the first time these commodities will be the leading feature of the British Industries Fair, to be held in Glasgow from August 19 to 31. British Dyes Ltd. and the Turkey Red Company have been exhibitors in the past at this fair, but this year a number of other concerns have signified their intention of displaying their wares.

Following the seizure of Carl Feldman, president and general manager of the Berlin Aniline Works, Philadelphia, as a dangerous enemy alien, the stock of the company, together with all correspondence and records, was taken over by Custodian of Alien Property Palmer. Feldman is being held at a Massachusetts detention camp pending an examination.

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The Biological Significance of Plant Pigments

Some very interesting results have been reached by J. Dufrènoy in investigating the source and function of the coloring matter of plants from a biological point of view. The general conclusions founded upon this work are that "The resinous secretion formed by certain plants is a mode of defense against auto-intoxication and senility. Secondarily it contributes to prevent, localize or cicatrize parasitic infections. More generally stated, *pigmentation is a defense reaction against an excess of radiation,* the plant living in the shade of its chlorophyll as the negro lives in the shade of his skin."

But these pigments, even chlorophyll, are not specific agents of biologic syntheses. Synthesis of hydrocarbon compounds is effected without their aid and it seems legitimate to assume the possibility of direct construction solely by photo-synthetic power of light, of the most complex components upon which the physical life of plants is based.—(*Rev. gen. des. Sci.* 1917, 28, 575.)

The Absorption Spectra of Some Polyhydroxy-anthraquinone Dyes in Concentrated Sulphuric Acid Solution and in the State of Vapor

That the value of the study of absorption phenomena is being more generally recognized is shown by the increasing number of articles on this subject appearing in current journals. David B. Meek has recently published an exhaustive series of tests on some hydroxy-anthraquinone dyes using the Nutting photometer and a large Hilger wave-length spectrometer. Absorption spectra of the dyes in solution were compared with those of the same colors in the state of vapor, vaporization being effected in a brass tube, supported in an electrical resistance furnace.

The bands of substances as vapors are sharper, narrower and more distinct. Alizarin, quinizarin, purpurin, anthragallol, alizarin cyanine, alizarin bordeaux, anthracene blue WR were tested as vapor, in alcoholic solution, sulphuric acid solution, aqueous potash solution and on cloth mordanted with tin, alum and chromium, the maxima of absorption bands being defined.

Alizarin cyanine in various organic solvents such as ether, amyl alcohol, chloroform, acetone, methyl alcohol, glacial acetic acid, pyridine, amyl ether, anisol, phenol, nitrobenzene is reported in wave-lengths and frequencies of maxima of absorption, the refractive index of the solvent, and the effect of piperidine as a solvent at different periods of time, being included.—(*Jour. Chem. Soc.,* 1917, 112, 969.)

Color Reaction of Aromatic Aldehydes

A number of reactions have been recommended for detecting aromatic aldehydes, among these being the fuchsin-sulfurous acid test, Fischer and Penzoldt's diazobenzene-sulphonic acid reaction, Riegler's test with phenylhydrazin oxalate and caustic potash, and others. Based on an observation by Häussler that when sulfanilic acid is mixed with vanillin, an orange color is produced (*Journ. Suisse Pharm.,* through *Pharm. Weekly.*), Pooth has worked out the following reaction for detecting aromatic aldehydes. Three to four milligrams of a ten per cent. solution of sodium sulfanilate, or sodium napthionate, are warmed on a water-bath and mixed with the alcoholic solution of the aldehyde.

In some cases the colored product of reaction crystallizes out at once. To one portion of the liquid a few drops of dilute sulfuric acid are added, by which a change of color takes place with some aldehydes; another portion is evaporated whereby the color generally becomes darker.—(Abstract in *The Druggist's Circular,* 1917, No. 12,640.)

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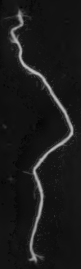

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